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Visualization of Air Particle Dynamics in an Engine Inertial Particle Separator[1] JASON WOLF, WEI ZHANG, Cleveland State Univ — Unmanned Aerial Vehicles (UAVs) are regularly deployed around the world in support of military, civilian and humanitarian efforts. Due to their unique mission profiles, these advanced UAVs utilize various internal combustion engines, which consume large quantities of air. Operating these UAVs in areas with high concentrations of sand and dust can be hazardous to the engines, especially during takeoff and landing. In such events, engine intake filters quickly become saturated and clogged with dust particles, causing a substantial decrease in the UAVs' engine performance and service life. Development of an Engine Air Particle Separator (EAPS) with high particle separation efficiency is necessary for maintaining satisfactory performance of the UAVs. Inertial Particle Separators (IPS) have been one common effective method but they experience complex internal particle-laden flows that are challenging to understand and model. This research employs an IPS test rig to simulate dust particle separation under different flow conditions. Soda lime glass spheres with a mean diameter of 35-45 microns are used in experiments as a surrogate for airborne particulates encountered during flight. We will present measurements of turbulent flow and particle dynamics using flow visualization techniques to understand the multiphase fluid dynamics in the IPS device. This knowledge can contribute to design better performing IPS systems for UAVs.

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